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(71) Applicant (*for all designated States except US*): **DOW CORNING CORPORATION** [US/US]; 2200 West Salzburg Road, Midland, MI 48686-0994 (US).

(72) Inventors; and

(75) Inventors/Applicants (*for US only*): **FERRITTO, Michael** [US/US]; 3004 Jeffrey Lane, Midland, MI 48640 (US). **ZUCHEN, Lin** [US/US]; 5025 Foxpoint Circle, Midland, MI 48642 (US). **SCHULZ, William, Jr.** [US/US]; 3841 Old Pine Trail, Midland, MI 48642 (US).

(74) Common Representative: **DECESARE, Jim**; Patent Department - Mail C01232, Dow Corning Corporation, 2200 West Salzburg Road, Midland, MI 48686-0994 (US).

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(54) Title: SILICONE LIQUID CRYSTALS, VESICLES, AND GELS

(57) Abstract: Silicone liquid crystals, silicone vesicles, and silicone gels are formed by combining (i) an amine functional silicone or an organic amine compound, (ii) an organic epoxide containing at least two epoxy groups or an epoxy functional silicone containing at least two epoxy groups, and (iii) a fluid such as water, a silicone fluid other than a silicone used in (i) and (ii), and a polar organic compound or nonpolar organic compound other than organic compounds used in (i) and (ii) in which the polar and nonpolar organic compound are present at a concentration to provide a level of solids less than 40 percent by weight based on the weight of (i) - (iii). These silicone liquid crystals, silicone vesicles, and silicone gels are useful in personal care for preparing various skin, hair, and underarm products.

SILICONE LIQUID CRYSTALS, VESICLES, AND GELS

[0001] This invention is directed to organosilicon compositions, and more particularly to certain silicone liquid crystals, silicone vesicles, and silicone gels.

[0002] At least as early as 1957, Plueddemann in US Patent 3,046,250 (July 24, 1962) had prepared new polymers in the form of solutions, fluids, viscous fluids, tars, and rubbery solids, by reacting organosilicon epoxides with amine compounds. However, the systems used to prepare these new polymers were anhydrous, and even when a polar solvent such as ethanol was used, it was present at a very high solids level during the reaction, i.e., at least forty-nine percent by weight or more. No new polymers were prepared by Plueddemann in silicone fluids like (i) volatile polydimethylsiloxanes such as hexamethyldisiloxane, octamethyltrisiloxane, and decamethylcyclopentasiloxane; or (ii) nonvolatile polydimethylsiloxanes with a viscosity in the range of 5-10,000 centistoke (mm^2/s).

[0003] As a result, Plueddemann was not able, and it was not Plueddemann's intent, to prepare any new organosilicon compositions in the form of a silicone liquid crystal, silicone vesicle, or silicone gel, which are the primary focus of the present invention.

[0004] Thus, the invention relates to silicone liquid crystals, silicone vesicles, and silicone gels, formed by combining (i) an amine functional silicone or an organic amine compound, (ii) an organic epoxide containing at least two epoxy groups or an epoxy functional silicone containing at least two epoxy groups, and (iii) water.

[0005] In a second embodiment, silicone gels are formed by combining (i) an amine functional silicone or an organic amine compound, (ii) an organic epoxide containing at least two epoxy groups or an epoxy functional silicone containing at

least two epoxy groups, and (iii) a silicone fluid other than the silicone defined in (i) and (ii).

[0006] A third embodiment involves forming silicone gels by combining (i) an amine functional silicone or an organic amine compound; (ii) an organic epoxide containing at least two epoxy groups or an epoxy functional silicone containing at least two epoxy groups; and (iii) a polar organic compound or a nonpolar organic compound other than the organic compounds defined in (i) and (ii), in which the polar organic compound or the nonpolar organic compound is present at a concentration to provide a level of solids less than 40 percent by weight based on the total weight of (i)-(iii), where (i) and (ii) are the solids.

[0007] One or more active ingredients can be included in any of the above embodiments.

[0008] Silicone liquid crystals and silicone vesicles can be prepared according to this invention by combining:

(i) 0.01-95 percent by weight of an amine functional silicone or an organic amine compound;

(ii) 0.01-95 percent by weight of an organic epoxide or an epoxy functional silicone;

(iii) 0.1-99.98 percent by weight of water; optionally

(iv) 1-30 percent by weight of a surfactant; and optionally

(v) 0.01-50 percent by weight of one or more active ingredients.

[0009] Silicone gels can be prepared according to this invention by combining:

(i) 0.1-99.89 percent by weight of an amine functional silicone or an organic amine compound;

(ii) 0.01-99.89 percent by weight of an organic epoxide or an epoxy functional silicone;

(iii) 0.1-99.89 percent by weight of a fluid which can be water, a silicone fluid other than a silicone used in (i) and (ii), a polar organic compound, or a non-polar organic

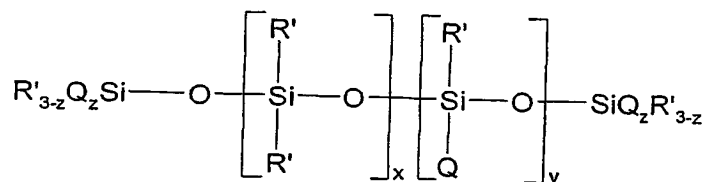
compound;

optionally

(iv) 1-30 percent by weight of a surfactant; and optionally

(v) 0.01-50 percent by weight of one or more active ingredients.

- 5 [0010] The amine functional polysiloxane used in preparing these compositions has the formula:



- 10 wherein R' denotes an alkyl group of 1 to 30 carbons, an aryl group, an aralkyl group, or an alkaryl group, with the proviso that at least 50 percent of the total number of R' groups are methyl; Q denotes an amine functional substituent of the formula -R''Z wherein R'' is a divalent alkylene radical of 3 to 6 carbon atoms and Z is a monovalent radical selected from the group consisting of -NR₂'', and -NR'''(CH₂)_bNR₂''';
- 15 wherein R''' denotes hydrogen or an alkyl group of 1 to 4 carbons, and b is a positive integer having a value of from 2 to 6; z has a value of 0 or 1; x has an average value of 25 to 3000; y has an average value of 0 to 3,000 when z is 1, y has an average value of 1 to 3,000 when z is 0.

- 20 [0011] Suitable R' groups are represented by and may be independently selected from among methyl, ethyl, propyl, isopropyl, butyl, isobutyl, phenyl, xenyl, benzyl, phenylethyl, and tolyl, with the proviso that at least fifty percent of the R' groups are methyl.

- 25 [0012] The alkylene radicals represented by R'' may include trimethylene, tetramethylene, pentamethylene, -CH₂CH(CH₃)CH₂-, and -CH₂CH₂CH(CH₃)CH₂-. Siloxanes where R'' is a trimethylene or an alkyl substituted trimethylene radical such as -CH₂CH(CH₃)CH₂-, are preferred.

[0013] Alkyl groups of 1 to 4 carbon atoms as represented by R' include methyl, ethyl, propyl, isopropyl, butyl, and isobutyl.

[0014] Useful Z radicals include the unsubstituted amine radical -NH_2 , alkyl substituted amine radicals such as -NHCH_3 , $\text{-NHCH}_2\text{CH}_2\text{CH}_2\text{CH}_3$, and $\text{-N(CH}_2\text{CH}_3)_2$; and aminoalkyl substituted amine radicals such as $\text{-NHCH}_2\text{CH}_2\text{NH}_2$, $\text{-NH(CH}_2)_6\text{NH}_2$, and $\text{-NHCH}_2\text{CH}_2\text{CH}_2\text{N(CH}_3)_2$.

[0015] When z is zero, the silicone polymer has only pendent amine functional substituents in the polymer chain. When z is one, the silicone polymer may have only terminal amine functional substituents or both terminal and pendent amine functional substituents in the polymer chain. Preferably, x may vary from a value of 25 to 500, and y may vary from zero to 100 when z is one and from one to 100 when z is zero. Most preferably, the value of $x + y$ is in the range of about 50 to 1,000.

[0016] The amine content, i.e., the number of amine functional groups in the molecule of the amine functional polysiloxane, is generally expressed as *mol percent amine*, and this is determined according to the relationship $y/\text{DP} \times 100$, where y is the value of integer y in the above formula for the amine functional polysiloxane, and the Degree of Polymerization (DP) is $x + y + 2$ which indicates the chain length of the amine functional polysiloxane.

[0017] Such amine functional polysiloxanes are well known in the art and available commercially from sources such as the Dow Corning Corporation, Midland, Michigan USA.

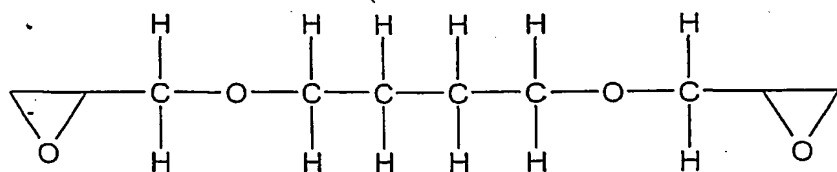
[0018] When it is desired to use an organic amine compound instead of an amine functional polysiloxane, reference may be had to Plueddemann's US Patent 3,046,250 for a detailed list of some representative organic amine compounds, among which are for example, ammonia, diethylene triamine, ethylene

diamine, methane diamine, *m*-phenylene diamine, methylene dianiline, benzohydrazide, guanidine, benzidene sulfone, thioacetamide, piperazine, *p*-amino benzoic acid, thiosemicarbizide, allanturic acid, *p,p'*-thiodianiline, *p*-bromophenyl hydrazine, benzene pentamine, and *N,N'*-dimethyl ethylene diamine.

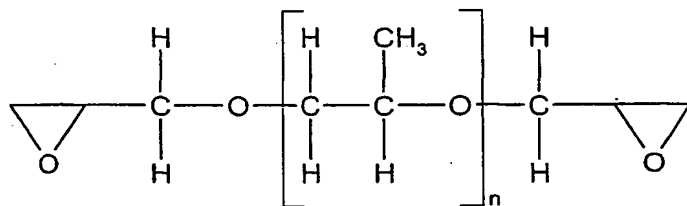
[0019] Organic epoxides containing at least two epoxy groups, i.e., diepoxides, suitable for use herein include compositions such as ethylene glycol diglycidyl ether, diethylene glycol diglycidyl ether, polyethylene glycol diglycidyl ether, glycerine diglycidyl ether, triglycidyl ether, propylene glycol diglycidyl ether, butanediol diglycidyl ether; 1,2,3,4-diepoxybutane; 1,2,4,5-diepoxypentane; 1,2,5,6-diepoxyhexane; 1,2,7,8-diepoxyoctane; 1,3-divinylbenzene diepoxide; 1,4-divinylbenzene diepoxide; 4,4'-isopropylidene diphenol diglycidyl ether, and hydroquinone diglycidyl ether.

[0020] Other polyglycidyl ethers of alkane polyols, polyglycidyl ethers of poly(alkylene glycols), diepoxy alkanes, diepoxy aralkanes, and polyphenol polyglycidyl ethers, can also be used herein.

[0021] Two especially preferred organic epoxides containing at least two epoxy groups are shown below, in which *n* is a positive integer determining the molecular weight of the epoxide.

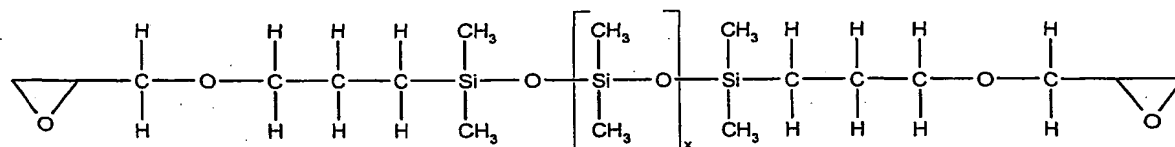


Butanediol Diglycidyl Ether



Poly(propylene glycol) Diglycidyl Ether

[0022] When it is desirable to use an epoxy functional silicone containing at least two epoxy groups instead of an organic epoxide containing at least two epoxy groups, a suitable epoxy functional silicone of the general structure shown below can be used, in which x represents an integer of one or more.



Epoxypropoxypropyl Terminated Polydimethylsiloxane

[0023] Such epoxy functional silicones are well known in the art and available commercially from sources such as the Dow Corning Corporation, Midland, Michigan USA. Typically, such silicones have a viscosity ranging from 1 to about 200 centistoke (mm²/s) and molecular weights of about 300-6,000.

[0024] If desired, organic epoxides and epoxy functional silicones containing a single epoxy group can be included as an additional component, in order to control the cross link density and the overall molecular weight of the silicone gel.

[0025] US Patent 5,948,855 (September 7, 1999) contains an extensive lists of appropriate silicone fluids which can be used, among which are for example, (i) volatile

polydimethylsiloxanes such as hexamethyldisiloxane, octamethyltrisiloxane, and decamethylcyclopentasiloxane; and (ii) nonvolatile polydimethylsiloxanes. These volatile and nonvolatile polydimethylsiloxanes include silicone fluids having a viscosity ranging from 0.65 to 10,000 centistoke (mm²/s).

[0026] US Patent 5,948,855 also contains an extensive list of *nonpolar organic compounds* which can be used, among which are fragrances such as musk and myrrh, and mixtures thereof.

In addition, *nonpolar organic compounds* such as natural oils derived from animal, vegetable, or mineral sources are also suitable. Most preferred are modern cosmetic oils known to be safe for cosmetic purposes such as almond oil, apricot kernel oil, avocado oil, cacao butter (theobroma oil), carrot seed oil, castor oil, citrus seed oil, coconut oil, corn oil, cottonseed oil, cucumber oil, egg oil, jojoba oil, lanolin oil, linseed oil, mineral oil, mink oil, olive oil, palm kernel oil, peach kernel oil, peanut oil, rapeseed oil, safflower oil, sesame oil, shark liver oil, soybean oil, sunflower seed oil, sweet almond oil, tallow (beef) oil, tallow (mutton) oil, turtle oil, vegetable oil, whale oil, and wheat germ oil.

[0027] Some *polar organic compounds* which can be used are monohydroxy alcohols such as ethyl alcohol and isopropyl alcohol; diols and triols such as propylene glycol, 2-methyl-1,3-propane diol HOCH₂CH(CH₃)CH₂OH, 1,2-hexanediol CH₃(CH₂)₃CH(OH)CH₂OH, and glycerol; glycerol esters such as glyceryl triacetate (triacetin), glyceryl tripropionate (tripropionin), and glyceryl tributyrinate (tributyrin); and polyglycols such as polyethylene glycols and polypropylene glycols, among which are PPG-14 butyl ether C₄H₉[OCH(CH₃)CH₂]₁₄OH.

[0028] The surfactant can be a nonionic, cationic, anionic, or a mixture of such surfactants. Most preferred are organic nonionic surfactants, but the nonionic surfactant can be one

containing a silicon atom. Most preferred are alcohol ethoxylates

$R_2-(OCH_2CH_2)_cOH$, most particularly fatty alcohol ethoxylates. Fatty alcohol ethoxylates typically contain the characteristic group $-(OCH_2CH_2)_cOH$ which is attached to fatty hydrocarbon residue R_2 which contains about eight to about twenty carbon atoms, such as lauryl (C_{12}), cetyl (C_{16}) and stearyl (C_{18}). While the value of "c" may range from 1 to about 100, its value is typically in the range of 2 to 40.

10 [0029] Some examples of suitable nonionic surfactants are polyoxyethylene (4) lauryl ether, polyoxyethylene (5) lauryl ether, polyoxyethylene (23) lauryl ether, polyoxyethylene (2) cetyl ether, polyoxyethylene (10) cetyl ether, polyoxyethylene (20) cetyl ether, polyoxyethylene (2) stearyl ether,

15 polyoxyethylene (10) stearyl ether, polyoxyethylene (20) stearyl ether, polyoxyethylene (21) stearyl ether, polyoxyethylene (100) stearyl ether, polyoxyethylene (2) oleyl ether, and polyoxyethylene (10) oleyl ether. These and other fatty alcohol ethoxylates are commercially available under

20 such names as ALFONIC®, BRIJ, GENAPOL®, LUTENSOL, NEODOL®, RENEX, SOFTANOL, SURFONIC®, TERGITOL®, TRYCOL, and VOLPO.

[0030] One especially useful nonionic surfactant is polyoxyethylene (23) lauryl ether, a product sold under the name BRIJ 35L by ICI Surfactants, Wilmington, Delaware. It has

25 an HLB of about 16.9

[0031] Cationic surfactants useful in the invention include compounds containing quaternary ammonium hydrophilic moieties in the molecule which are positively charged, such as quaternary ammonium salts represented by $R_3R_4R_5R_6N^+X^-$ where R_3 to R_6 are alkyl groups containing 1-30 carbon atoms, or alkyl groups derived from tallow, coconut oil, or soy; and X is halogen such as chlorine or bromine, or X can be a methosulfate group. Most preferred are dialkyldimethyl

30 ammonium salts represented by $R_7R_8N^+(CH_3)_2X^-$, where R_7 and R_8

are alkyl groups containing 12-30 carbon atoms, or alkyl groups derived from tallow, coconut oil, or soy; and X is halogen or a methosulfate group. Monoalkyltrimethyl ammonium salts can also be employed, and are represented by

- 5 $R_9N^+(CH_3)_3X^-$ where R_9 is an alkyl group containing 12-30 carbon atoms, or an alkyl group derived from tallow, coconut oil, or soy; and X is halogen or a methosulfate group.

[0032] Representative quaternary ammonium salts are dodecyltrimethyl ammonium bromide (DTAB), didodecyldimethyl ammonium bromide, dihexadecyldimethyl ammonium chloride, dihexadecyldimethyl ammonium bromide, dioctadecyldimethyl ammonium chloride, dieicosyldimethyl ammonium chloride, didocosyldimethyl ammonium chloride, dicoconutdimethyl ammonium chloride, ditallowdimethyl ammonium chloride, and
10 ditallowdimethyl ammonium bromide. These and other quaternary ammonium salts are commercially available under such names as ADOGEN, ARQUAD, SERVAMINE, TOMAH, and VARIQUAT.

[0033] Examples of anionic surfactants include sulfonic acids and their salt derivatives; alkali metal
20 sulfosuccinates; sulfonated glyceryl esters of fatty acids such as sulfonated monoglycerides of coconut oil acids; salts of sulfonated monovalent alcohol esters such as sodium oleyl isothionate; amides of amino sulfonic acids such as the sodium salt of oleyl methyl tauride; sulfonated products of fatty
25 acid nitriles such as palmitonitrile sulfonate; sulfonated aromatic hydrocarbons such as sodium alpha-naphthalene monosulfonate; condensation products of naphthalene sulfonic acids with formaldehyde; sodium octahydro anthracene sulfonate; alkali metal alkyl sulfates such as sodium lauryl
30 (dodecyl) sulfate $CH_3(CH_2)_{11}OSO_3Na$; ether sulfates having alkyl groups of eight or more carbon atoms; and alkylaryl sulfonates having one or more alkyl groups of eight or more carbon atoms.

[0034] Commercial anionic surfactants useful in this
35 invention include triethanolamine linear alkyl sulfonate sold

under the name BIO-SOFT N-300 by the Stepan Company, Northfield, Illinois; sulfates sold under the name POLYSTEP by the Stepan Company; and sodium n-hexadecyl diphenyloxide disulfonate sold under the name DOWFAX 8390 by The Dow Chemical Company, Midland, Michigan.

[0035] The liquid crystals, vesicles, and gels, prepared according to the invention may contain one or more active ingredients in one or more of their phase(s). Some representative aqueous and polar organic compound soluble active ingredients are (i) Vitamins, (ii) drugs including activated antiperspirant salts such as aluminum chlorohydrate and aluminum-zirconium trichlorohydrate, or (iii) α -hydroxy acids such as glycolic acid, lactic acid, tartaric acid, and citric acid, i.e., *fruit acids*. US Patent 5,948,855 contains an extensive list of aqueous and polar organic compound soluble Vitamins and drugs which can be used, among which are Vitamin C, Vitamin B₁, Vitamin B₂, Vitamin B₆, Vitamin B₁₂, niacin, folic acid, biotin, and pantothenic acid.

[0036] US Patent 5,948,855 also contains an extensive list of nonpolar oil soluble active ingredients which can be carried in a phase(s) of the silicone fluid or nonpolar organic compound, such as vitamins and drugs among which are Vitamin A₁, RETINOL, C₂-C₁₈ esters of RETINOL, Vitamin E, TOCOPHEROL, esters of Vitamin E, RETINYL ACETATE, RETINYL PALMITATE, RETINYL PROPIONATE, α -TOCOPHEROL, TOCOPHERSOLAN, TOCOPHERYL ACETATE, TOCOPHERYL LINOLEATE, TOCOPHERYL NICOTINATE, TOCOPHERYL SUCCINATE, and mixtures thereof.

[0037] Other common types of active ingredients can also be included in any phase(s), if desired, such as a fragrance or a sunscreen, i.e., an UV absorber/UV light stabilizer.

[0038] Silicone liquid crystals, silicone vesicles, and silicone gels of the invention can be prepared at room temperature using simple propeller mixers, turbine-type mixers, Brookfield counter-rotating mixers, or homogenizing

mixers. No special equipment or processing conditions are generally required. Often, simple hand shaking is sufficient. Heat facilitates their formation, and so these compositions can be prepared at temperatures ranging from 25-100 °C.

5

EXAMPLES

[0039] The following examples are set forth in order to illustrate this invention in more detail. In these examples, the amine functional silicone that was used had a structure generally corresponding to the formula set forth above, in which R', x, y, z, and Q, are shown in Table 1.

10

TABLE 1

Example	R'	x	y	z	Q
1	CH ₃	269.5	117.5	0	-CH ₂ CH(CH ₃)CH ₂ NHCH ₂ CH ₂ NH ₂
2	CH ₃	269.5	117.5	0	-CH ₂ CH(CH ₃)CH ₂ NHCH ₂ CH ₂ NH ₂
3	CH ₃	89.9	8.0	0	-CH ₂ CH(CH ₃)CH ₂ NHCH ₂ CH ₂ NH ₂
4	CH ₃	269.5	117.5	0	-CH ₂ CH(CH ₃)CH ₂ NHCH ₂ CH ₂ NH ₂
5	CH ₃	85.0	15.0	0	-CH ₂ CH ₂ CH ₂ NH ₂
6	CH ₃	85.0	15.0	0	-CH ₂ CH ₂ CH ₂ NH ₂
7	CH ₃	85.0	15.0	0	-CH ₂ CH ₂ CH ₂ NH ₂
8	CH ₃	85.0	15.0	0	-CH ₂ CH ₂ CH ₂ NH ₂
9	CH ₃	269.5	117.5	0	-CH ₂ CH(CH ₃)CH ₂ NHCH ₂ CH ₂ NH ₂
10	CH ₃	269.5	117.5	0	-CH ₂ CH(CH ₃)CH ₂ NHCH ₂ CH ₂ NH ₂
11	CH ₃	269.5	117.5	0	-CH ₂ CH(CH ₃)CH ₂ NHCH ₂ CH ₂ NH ₂

Example 1

[0040] 0.5099 g of an amine functional silicone having the characteristics as defined in Table 1, 0.1435 g of 1,4-butanediol diglycidyl ether, and 4.7143 g of H₂O were weighed in a vial. The vial was placed in an 80 °C oven for 2 hours resulting in a cloudy solution. Optical microscopy confirmed that the particles were birefringent indicating the formation and existence of vesicles.

20

Example 2

[0041] 0.5337 g of an amine functional silicone having the characteristics as defined in Table 1, 0.6446 g of polyethylene glycol diglycidyl ether having a molecular weight of about 526, 0.3113g of BRIJ 35L nonionic surfactant, and 5.0908 g of H₂O were weighed into a vial. The vial was placed in an 80 °C oven for 2 hours resulting in the formation of a clear gel with a blue tint. Optical microscopy confirmed the existence and formation of a lamellar liquid crystal.

Example 3

[0042] First, 3.2685 g of an amine functional silicone having the characteristics as defined in Table 1, 6.1542 g of a one percent salt solution containing 10 percent by weight of sodium dodecyl sulfate anionic surfactant, and 22.0164 g of H₂O were weighed into a vial. Second, 10.0905 g of the mixture in the vial; 0.5027 g of PARSOL MCX, a UV absorber/UV light stabilizer which is 2-ethylhexyl-p-methoxy cinnamate, sold by Givaudan-Roure, Clifton, New Jersey; and 0.1684 g of polypropylene glycol diglycidyl ether having a molecular weight of about 640; were placed in another vial. This vial was placed in an 80 °C oven for 4 hours resulting in the formation of a cloudy dispersion. Optical microscopy confirmed that the particles observed were vesicles. This example also demonstrates the use of a polymerized vesicle to entrap an active ingredient.

Example 4

[0043] 0.5060 g of an amine functional silicone having the characteristics as defined in Table 1, 1.0058 g of polyethylene glycol diglycidyl ether having a molecular weight of about 526, 0.4970 g of BRIJ 35L nonionic surfactant, and 8.2702 g of H₂O were weighed into a vial. The vial was placed into an 80 °C oven for 2 hours resulting in the formation of a clear gel.

Example 5

[0044] 1.5165 g of an amine functional silicone having the characteristics as defined in Table 1, 0.5000 g of 1,4-butanediol diglycidyl ether, 6.0165 g of a water solution containing 20 percent by weight of sodium dodecyl sulfate anionic surfactant, and 0.7154 g of 2-methyl-1,3-propanediol which was used as a cosolvent, were weighed into a vial. The vial was placed in an 80 °C oven for 2 hours resulting in the formation of a clear gel.

Example 6

[0045] 2.1278 g of an amine functional silicone having the characteristics as defined in Table 1, 2.2221 g of 1,4-butanediol diglycidyl ether, 5.0538 g of a water solution containing 20 percent by weight of sodium dodecyl sulfate anionic surfactant, and 1.0193 g of decamethylcyclopentasiloxane, were weighed into a vial. The vial was placed in an 80 °C oven for 2 hours resulting in the formation of a clear gel. This example also demonstrates the inclusion of a volatile cyclic polydimethylsiloxane $[(CH_3)_2SiO]_5$ in a water based gel.

Example 7

[0046] 1.5452 g of an amine functional silicone having the characteristics as defined in Table 1, 6.1404 g of a water solution containing 20 percent by weight of sodium dodecyl sulfate anionic surfactant, 0.9542 g of polyethylene glycol diglycidyl ether having a molecular weight of about 200, 0.5100 g of 1,4-butanediol diglycidyl ether, and 0.1256 g of a fragrance sold under the name JOOP, were weighed into a vial. The vial was placed in an 80 °C oven for one hour resulting in the formation of a clear gel having a yellow tint. This example also demonstrates the use of a gel to entrap an active ingredient.

Example 8

[0047] Into a reaction vial were placed 25.5 g of decamethylcyclopentasiloxane, 0.70 g of 1,4-butanediol diglycidyl ether, and 3.80 g of an amine functional silicone with a degree of polymerization of 100, containing about 15 mole percent of aminopropyl units, and having the characteristics as defined in Table 1. The mixture was stirred until homogeneous and placed in a 70 °C ± 5 °C bath for 2 hours. Upon removal from the bath, a cloudy gel had been obtained.

Example 9

[0048] 5.40 g of an amine functional silicone having the characteristics as defined in Table 1, 4.60 g of 1,4-butanediol diglycidyl ether, and 40.25 g of propylene glycol were weighed into a vial. The vial was placed in an 80 °C oven for 2 hours resulting in the formation of a clear gel.

Example 10

[0049] 1.0901 g of an amine functional silicone having the characteristics as defined in Table 1, 0.9350 g of 1,4-butanediol diglycidyl ether, and 8.0942 g of an antiperspirant salt active, were weighed into a vial. The antiperspirant salt active used in this example was a propylene glycol solution containing about 32 percent by weight of an aluminum-zirconium tetrachlorohydrate glycine complex. The vial was placed in an 80 °C oven for 2 hours resulting in the formation of a clear gel.

Example 11

[0050] 2.3964 g of an amine functional silicone having the characteristics as defined in Table 1, 1.9428 g of 1,4-butanediol diglycidyl ether, and 6.0644 g of PPG-14 butyl ether were weighed in a vial. The vial was placed in an 80 °C oven for 2 hours resulting in the formation of a clear gel.

[0051] It should be noted that one of the benefits derived from crosslinked silicone liquid crystals and silicone

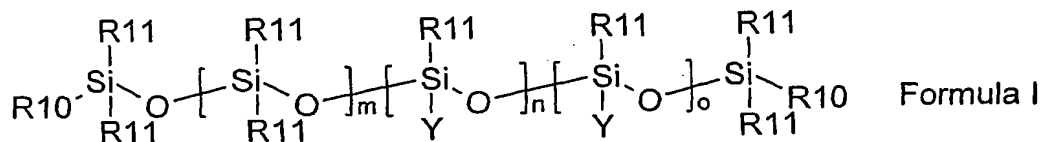
vesicles prepared according to this invention is their structural integrity against changes in such parameters as temperature, and the presence or absence of other components such as water, surfactants, and oils. Another benefit is their reduced permeability for entrapped active ingredients by the formation of more compact structures following crosslinking.

[0052] Compositions according to this invention are useful in personal care, for example, in preparing antiperspirants and deodorants. They can be used in skin creams, skin care lotions, moisturizers, facial treatments such as acne or wrinkle removers, personal and facial cleansers, bath oils, perfumes, colognes, sachets, sunscreens, pre-shave and after-shave lotions, shaving soaps, and shaving lathers. They can be used in hair shampoos, hair conditioners, hair sprays, mousses, permanents, depilatories, cuticle coats, and temporary or permanent hair colorants. In cosmetics, they can be added to make-ups, color cosmetics, foundations, blushes, lipsticks, eyeliners, mascara, oil removers, color cosmetic removers, and powders. In such applications, the compositions may include oil soluble, polar solvent soluble, and water soluble ingredients such as vitamins as noted above.

[0053] These compositions are also capable of functioning as carriers for pharmaceuticals, biocides, herbicides, pesticides, and other biologically active substances; and they have utility as additives for cellulosic or synthetic nonwoven carrier substrates used in wet-like cleansing wipes such as wet-wipes, tissues, and towels, marketed generally for personal hygiene and household cleaning tasks.

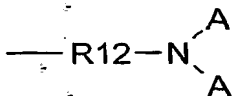
[0054] Since the exact nature of the organosilicon compositions described in this invention is largely dependent upon components used in their preparation, it is difficult to specify the precise nature of their structure. However, it is believed that these organosilicon compositions would have approximate structures generally corresponding to one of the following Formulas I or II.

[0055] Thus, the organosilicon composition can have a structure defined by the formula:

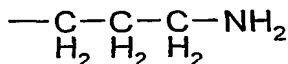


[0056] In Formula I, R11 is an alkyl group such as methyl, ethyl, propyl, butyl, pentyl, hexyl, or isobutyl; an aryl group such as phenyl, biphenyl, naphthyl, or anthracyl; an alkaryl group such as tolyl or xylyl; or an aralkyl group such as benzyl, phenylethyl, or 2-phenylpropyl. R10 can be the same as R11, or R10 can be Y.

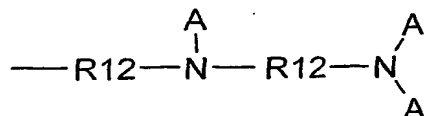
[0057] Y is the structure



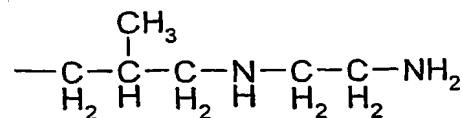
such as the group



or Y can have the structure



such as the group



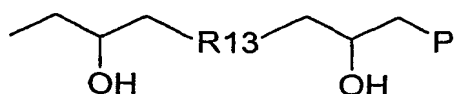
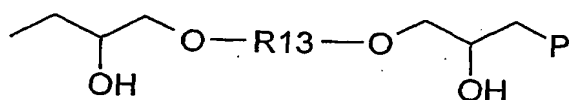
The value of m in Formula I is 1-5,000. The value of n and o in Formula I is 1-200.

[0058] R12 in structure Y shown above represents a divalent alkyl group such as methylene, ethylene, propylene, or butylene; a divalent aryl group such as phenylene,

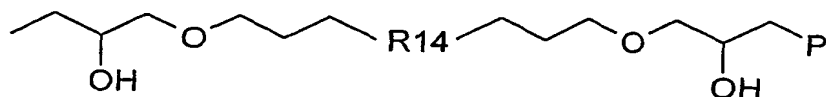
biphenylene, naphthylene, or anthracylene; a divalent alkaryl group such as tolylene or xylylene; or a divalent aralkyl group such as benzylene, phenylethylene, or 2-phenylpropylene.

[0059] The A constituent in structure Y represents an alkyl group such as methyl, ethyl, propyl, butyl, pentyl, hexyl, or isobutyl; an aryl group such as phenyl, biphenyl, naphthyl, or anthracyl; an alkaryl group such as tolyl or xylyl; an aralkyl group such as benzyl, phenylethyl, or 2-phenylpropyl; or A can be a hydrogen atom.

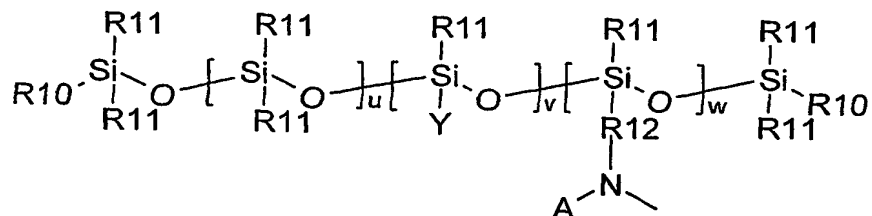
10 [0060] In addition, A can be a group such as



or



15 [0061] In groups A above, P represents the structure

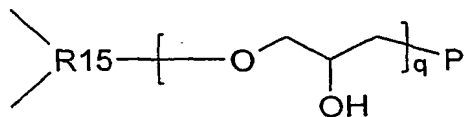


in which u is 1-5,000; v and w are 1-200; and R10, R11, Y, and A, are the same as previously defined.

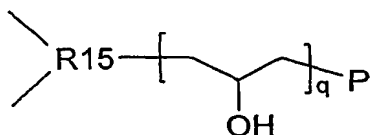
[0062] R13 represents a divalent alkyl group such as methylene, ethylene, propylene, or butylene; a divalent aryl group such as phenylene, biphenylene, naphthylene, or anthracylene; a divalent alkaryl group such as tolylene or xylylene; or a divalent aralkyl group such as benzylene, phenylethylene, or 2-phenylpropylene.

[0063] In addition, R13 can be a poly(alkylene oxide) group such as poly(ethylene oxide), a representative example of which is $-(CH_2CH_2O)_{1-30}-$, poly(propylene oxide), a representative example of which is $-(CH_2CHCH_3O)_{1-30}-$, or a mixed poly(ethylene oxide/propylene oxide) group.

[0064] Further, R13 can be a structure such as

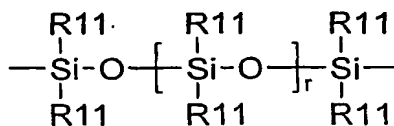


or

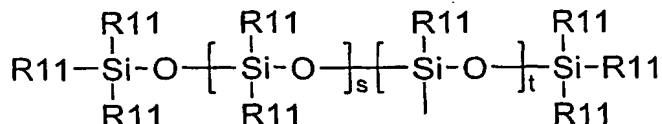


[0065] R15 represents a divalent alkyl group such as methylene, ethylene, propylene, or butylene; a divalent aryl group such as phenylene, biphenylene, naphthylene, or anthracylene; a divalent alkaryl group such as tolylene or xylylene; or a divalent aralkyl group such as benzylene, phenylethylene, or 2-phenylpropylene; a poly(alkylene oxide) group such as poly(ethylene oxide), poly(propylene oxide), or a mixed poly(ethylene oxide/propylene oxide); q is 0-60; and P is the same as previously defined.

[0066] The R14 group shown in the groups A above is representative of structure such as

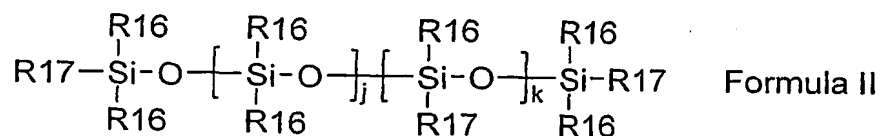


or



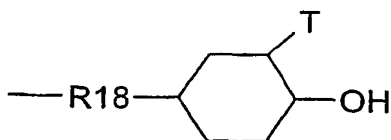
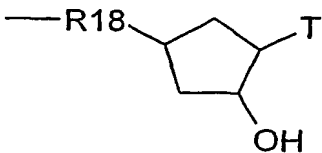
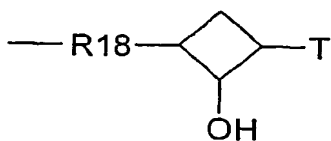
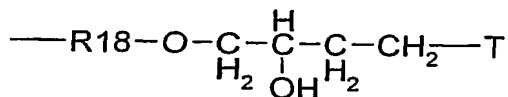
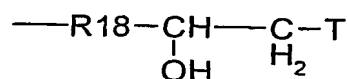
where r and s are 0-400; t is 2-100; and R11 has the same meaning as previously defined.

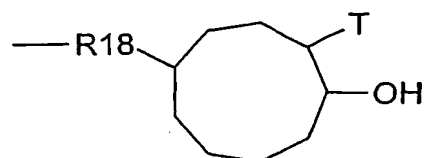
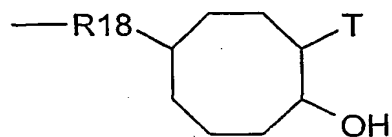
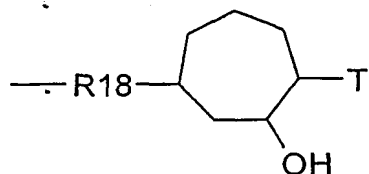
[0067] The organosilicon composition can also have a structure defined by the formula:



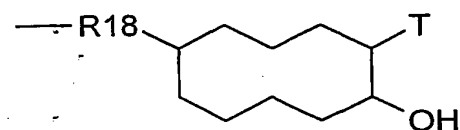
[0068] In Formula II, j is 1-5,000, and k is 0-100. R16 is an alkyl group such as methyl, ethyl, propyl, butyl, pentyl, hexyl, or isobutyl; an aryl group such as phenyl, biphenyl, naphthyl, or anthracyl; an alkaryl group such as tolyl or xylyl; or an aralkyl group such as benzyl, phenylethyl, or 2-phenylpropyl.

[0069] R17 can be the same as R16, or R17 can consist of a structure such as





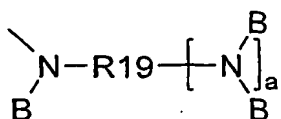
or



[0070] In these structures, R18 represents a divalent alkyl group such as methylene, ethylene, propylene, or butylene; a divalent aryl group such as phenylene, biphenylene, naphthylene, or anthracylene; a divalent alkaryl group such as tolylene or xylylene; or a divalent aralkyl group such as benzylene, phenylethylene, or 2-phenylpropylene.

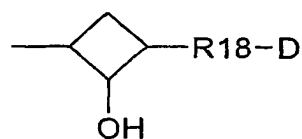
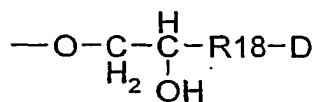
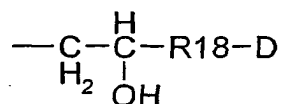
[0071] It should be understood that in the ring structures shown above, while the T and OH groups must occupy adjacent sites, the R18 group can be attached to any remaining unoccupied site. As illustrated above, the various structure shown are merely representative of one of the arrangements possible.

[0072] T in these structures represents the group

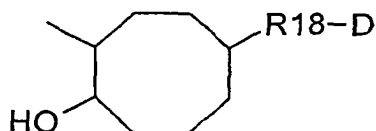
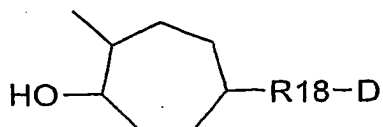
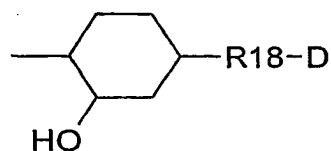
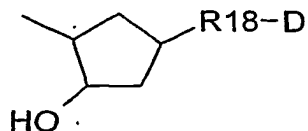


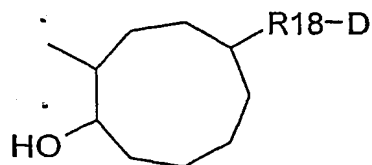
in which a is 1-20. The B group can be hydrogen; an alkyl group such as methyl, ethyl, propyl, butyl, pentyl, hexyl, or isobutyl; an aryl group such as phenyl, biphenyl, naphthyl, or anthracyl; an alkaryl group such as tolyl or xylyl; or an
 5 aralkyl group such as benzyl, phenylethyl, or 2-phenylpropyl.

[0073] In addition, the B group can consist of structures such as

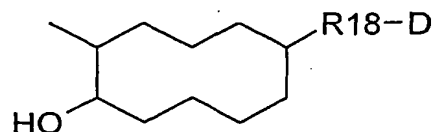


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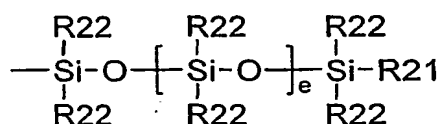


or



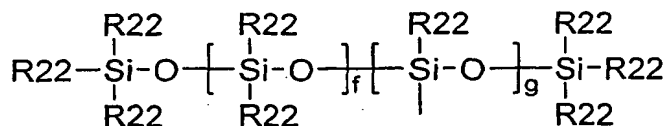
[0074] In these B groups, R18 is the same as previously defined. While the free site - and the OH group in the ring structures shown above must be located at adjacent positions on the ring, the R18-D group can be attached to the ring at any one of the remaining unoccupied positions, and the structures illustrated merely represent one of the arrangements possible.

[0075] The constituent D of the B group has the structure



where e is 0-400. R21 can be an alkyl group such as methyl, ethyl, propyl, butyl, pentyl, hexyl or isobutyl; an aryl group such as phenyl, biphenyl, naphthyl, or anthracyl; an alkaryl group such as tolyl or xylyl; an aralkyl group such as benzyl, phenylethyl, or 2-phenylpropyl.

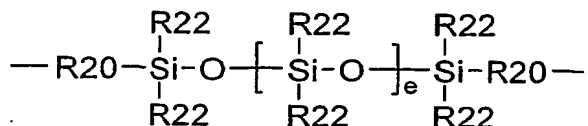
[0076] R21 can also occupy a D site, or R21 can further consist of a structure such as



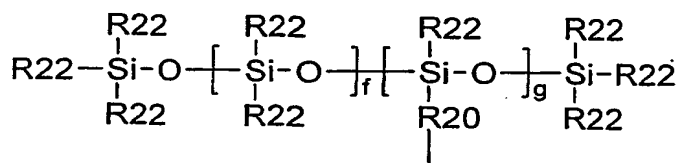
where f is 0-400, g is 2-100, and R22 is an alkyl group such as methyl, ethyl, propyl, butyl, pentyl, hexyl or isobutyl; an aryl group such as phenyl, biphenyl, naphthyl or anthracyl; an

alkaryl group such as tolyl or xylyl; or an aralkyl group such as benzyl, phenylethyl or 2-phenylpropyl.

[0077] R19 in T is an alkyl group such as methyl, ethyl, propyl, butyl, pentyl, hexyl, or isobutyl; an aryl group such as phenyl, biphenyl, naphthyl, or anthracyl; an alkaryl group such as tolyl or xylyl; or an aralkyl group such as benzyl, phenylethyl, or 2-phenylpropyl. Alternatively, R19 can consist of structures such as



10 or



where e and f are 0-400, g is 2-100, and R22 is the same as previously defined.

[0078] R20 is an alkyl group such as methyl, ethyl, propyl, butyl, pentyl, hexyl, or isobutyl; an aryl group such as phenyl, biphenyl, naphthyl, or anthracyl; an alkaryl group such as tolyl or xylyl; an aralkyl group such as benzyl, phenylethyl, or 2-phenylpropyl; an alkyl amine group such as isobutyl ethylene amine; or oxygen.

CLAIMS:

1. A composition comprising the reaction product obtained by combining (i) an amine functional silicone or an organic amine compound, (ii) an organic epoxide containing at least two epoxy groups or an epoxy functional silicone containing at least two epoxy groups, and (iii) water.

2. A composition according to Claim 1 including (iv) a surfactant.

3. A composition according to Claim 1 in which the organic epoxide (ii) is 1,4-butanediol diglycidyl ether, polyethylene glycol diglycidyl ether, or polypropylene glycol diglycidyl ether.

4. A composition comprising the reaction product obtained by combining (i) an amine functional silicone or an organic amine compound, (ii) an organic epoxide containing at least two epoxy groups or an epoxy functional silicone containing at least two epoxy groups, and (iii) a silicone fluid other than the silicone defined in (i) and (ii).

5. A composition according to Claim 4 in which the organic epoxide (ii) is 1,4-butanediol diglycidyl ether, polyethylene glycol diglycidyl ether, or polypropylene glycol diglycidyl ether.

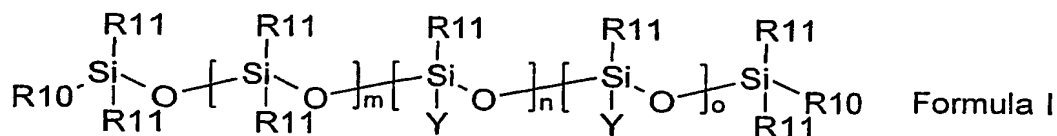
6. A composition according to Claim 4 in which the silicone fluid (iii) is a volatile polydimethylsiloxane or a nonvolatile polydimethylsiloxane having a viscosity of 0.65-10,000 centistoke (mm²/s).

7. A composition comprising the reaction product obtained by combining (i) an amine functional silicone or an organic amine compound; (ii) an organic epoxide containing at least two epoxy groups or an epoxy functional silicone containing at least two epoxy groups; and (iii) a polar organic compound or a nonpolar organic compound other than the organic compounds defined in (i) and (ii), in which the polar organic compound or the nonpolar organic compound is present in the composition at a concentration to provide a level of solids less than 40

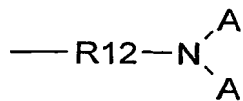
percent by weight based on the total weight of (i)-(iii), where (i) and (ii) are the solids.

8. A composition according to Claim 7 in which the organic epoxide (ii) is 1,4-butanediol diglycidyl ether, polyethylene glycol diglycidyl ether, or polypropylene glycol diglycidyl ether.

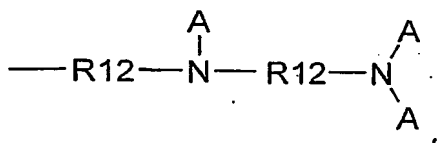
9. A composition comprising as a first component, an organosilicon polymer, and as a second component, (i) water, (ii) a volatile polydimethylsiloxane, (iii) a nonvolatile polydimethylsiloxane having a viscosity of 0.65-10,000 centistoke (mm^2/s), (iv) a polar organic compound, or (v) a nonpolar organic compound, the polar organic compound and the nonpolar organic compound being present in the composition at a concentration to provide a level of solids of less than 40 percent by weight, based on the total weight of the first component and the second component; the organosilicon polymer having the formula:



in R11 is an alkyl group, an aryl group, an alkaryl group, or an aralkyl group; R10 is the same as R11 or R10 is Y, in which Y is a structure represented by

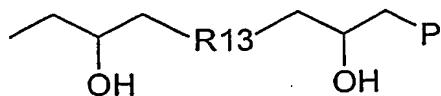
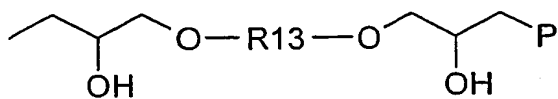


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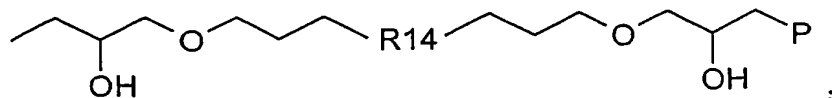


where m is 1-5,000, n and o are each 1-200; R12 is a divalent alkyl group, a divalent aryl group, a divalent alkaryl group, or a divalent aralkyl group; A is an alkyl group, an aryl

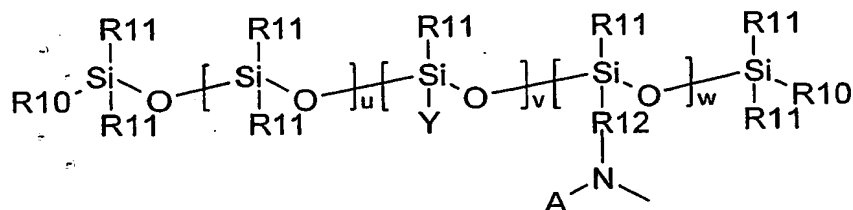
group, an alkaryl group, an aralkyl group, hydrogen, or a group represented by



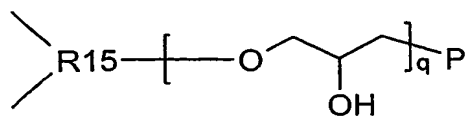
5 or



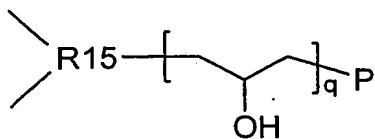
in which P is



10 where u is 1-5,000, v and w are each 1-200, and R₁₀, R₁₁, Y, and A, are the same as previously defined; R₁₃ is a divalent alkyl group, a divalent aryl group, a divalent alkaryl group, a divalent aralkyl group, a poly(alkylene oxide) group, the structure

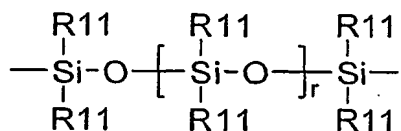


15 or the structure

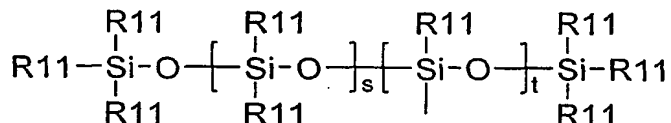


where R₁₅ is a divalent alkyl group, a divalent aryl group, a divalent alkaryl group, a divalent aralkyl group, or a

poly(alkylene oxide) group, q is 0-60, and P is the same as previously defined; R14 is

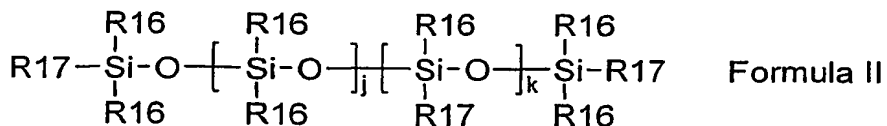


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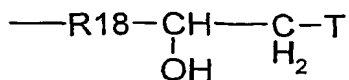


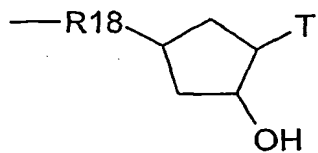
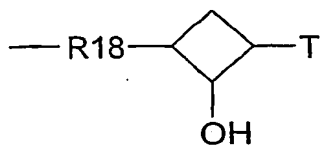
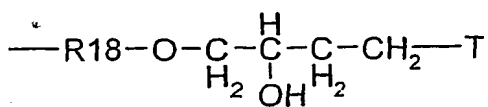
where r and s are each 0-400, t is 2-100, and R11 is the same as previously defined.

10. A composition comprising as a first component, an organosilicon polymer, and as a second component, (i) water, (ii) a volatile polydimethylsiloxane, (iii) a nonvolatile polydimethylsiloxane having a viscosity of 0.65-10,000 centistoke (mm²/s), (iv) a polar organic compound, or (v) a nonpolar organic compound, the polar organic compound and the nonpolar organic compound being present in the composition at a concentration to provide a level of solids of less than 40 percent by weight, based on the total weight of the first component and the second component; the organosilicon polymer having the formula:

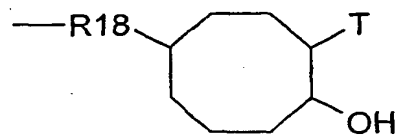
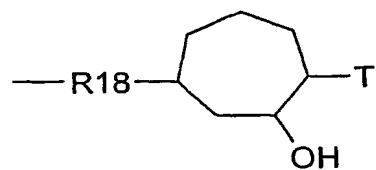
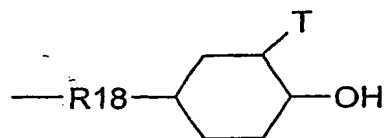


where j is 1-5,000, k is 0-100, R16 is an alkyl group, an aryl group, an alkaryl group, or an aralkyl group; R17 is the same as R16, or R17 represents a structure selected from the group consisting of

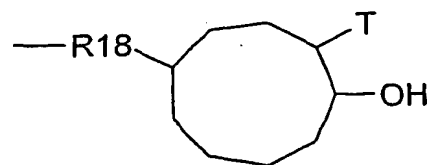




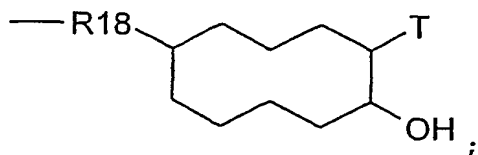
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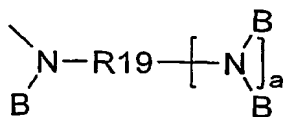


and



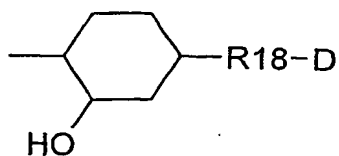
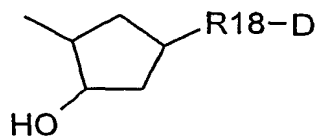
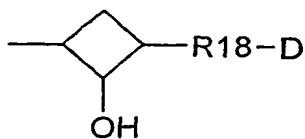
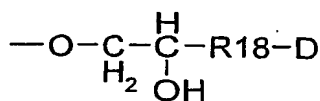
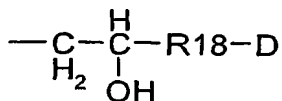
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where R18 is a divalent alkyl group, a divalent aryl group, a divalent alkaryl group, or a divalent aralkyl group; T is the group

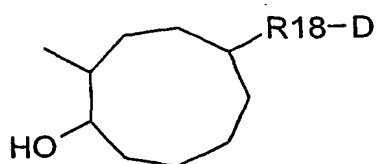
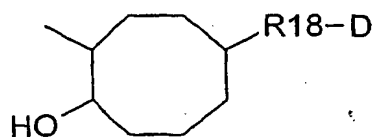
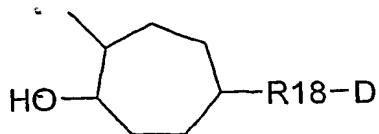


where a is 1-20; B is hydrogen, an alkyl group, an aryl group, an alkaryl group, an aralkyl group, or B is selected from the group consisting of

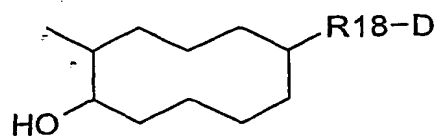
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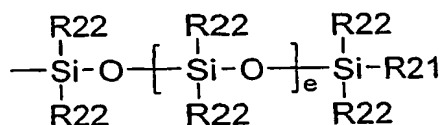
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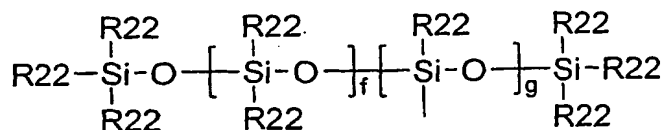
and.



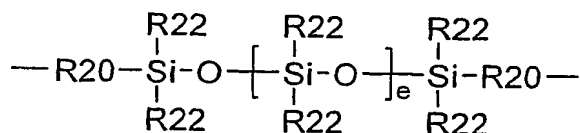
where R18 is the same as previously defined, and D is



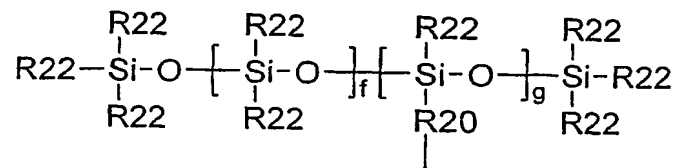
where e is 0-400; R21 is an alkyl group, an aryl group, an alkaryl group, an aralkyl group, or R21 is selected from the group consisting of



where f is 0-400, g is 2-100; R19 is an alkyl group, an aryl group, an alkaryl group, an aralkyl group,



and



5 where e and f are 0-400, g is 2-100; R20 is an alkyl group, an aryl group, an alkaryl group, an aralkyl group, an alkyl amine group, or oxygen; and R22 is an alkyl group, an aryl group, an alkaryl group, or an aralkyl group.

(19) World Intellectual Property Organization
International Bureau



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24 October 2002 (24.10.2002)

PCT

(10) International Publication Number
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(51) International Patent Classification⁷: C08G 59/00, 59/50, C08L 83/00

(21) International Application Number: PCT/US02/04433

(22) International Filing Date: 12 February 2002 (12.02.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/833,400 11 April 2001 (11.04.2001) US

(71) Applicant (for all designated States except US): **DOW CORNING CORPORATION** [US/US]; 2200 West Salzburg Road, Midland, MI 48686-0994 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **FERRITTO, Michael** [US/US]; 3004 Jeffrey Lane, Midland, MI 48640 (US). **ZUCHEN, Lin** [US/US]; 5025 Foxpoint Circle, Midland, MI 48642 (US). **SCHULZ, William, Jr.** [US/US]; 3841 Old Pine Trail, Midland, MI 48642 (US).

(74) Common Representative: **DECESARE, Jim**; Patent Department - Mail C01232, Dow Corning Corporation, 2200 West Salzburg Road, Midland, MI 48686-0994 (US).

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GI, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PI, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

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Declarations under Rule 4.17:

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for all designations
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GI, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW, ARIPO patent (GI, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)
- of inventorship (Rule 4.17(iv)) for US only

Published:

- with international search report

(88) Date of publication of the international search report:
13 February 2003

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: SILICONE LIQUID CRYSTALS, VESICLES, AND GELS

(57) Abstract: Silicone liquid crystals, silicone vesicles, and silicone gels are formed by combining (i) an amine functional silicone or an organic amine compound, (ii) an organic epoxide containing at least two epoxy groups or an epoxy functional silicone containing at least two epoxy groups, and (iii) a fluid such as water, a silicone fluid other than a silicone used in (i) and (ii), and a polar organic compound or nonpolar organic compound other than organic compounds used in (i) and (ii) in which the polar and nonpolar organic compound are present at a concentration to provide a level of solids less than 40 percent by weight based on the weight of (i) - (iii). These silicone liquid crystals, silicone vesicles, and silicone gels are useful in personal care for preparing various skin, hair, and underarm products.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 02/04433

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C08G59/00 C08G59/50 C08L83/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C08G C08L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 863 988 A (HASHIMOTO TAKESHI ET AL) 26 January 1999 (1999-01-26) column 7, line 11-21; claim 2; example 28 column 9, line 40-44 ---	1-6
X	US 5 618 860 A (MOWRER NORMAN R ET AL) 8 April 1997 (1997-04-08) claim 1; examples ---	1-6
X	WO 98 32792 A (AMERON INT CORP ;MOWRER NORMAN R (US); ROJAS J LUIS (US); FOSCANTE) 30 July 1998 (1998-07-30) claims; examples --- -/--	1-6



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

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- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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- "&" document member of the same patent family

Date of the actual completion of the international search

9 August 2002

Date of mailing of the international search report

29.10.02

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Ellrich, K

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 02/04433

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DATABASE WPI Section Ch, Week 198832 Derwent Publications Ltd., London, GB; Class A28, AN 1988-223091 XP002209257 & JP 63 156867 A (YOKOHAMA RUBBER CO LTD), 29 June 1988 (1988-06-29) abstract -----	1-6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 02/04433

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: 1(part), 7 (part)
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
see FURTHER INFORMATION sheet PCT/ISA/210

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-6

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box 1.2

Claims Nos.: 1(part), 7 (part)

Present claims 1 and 7 relate to an extremely large number of possible products. Support within the meaning of Article 6 PCT and/or disclosure within the meaning of Article 5 PCT is to be found, however, for only a very small proportion of the products claimed. In the present case, the claims so lack support (see for example the present title : SILICONE liquid crystals, vesicles and gels), and the application so lacks disclosure, that a meaningful search over the whole of the claimed scope is impossible. Consequently, the search has been carried out for those parts of the claims which appear to be supported and disclosed, namely those parts relating to the products wherein at least one (of epoxy or amine) functional compound has a silicone backbone/part.

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-6

Composition of reaction product obtained by combining an amine, an organic epoxide (at least one having a silicone backbone) and water

2. Claims: 7-8

Composition of reaction product obtained by combining an amine, an organic (poly)epoxide (at least one having a silicone backbone) and a particular amount of a polar organic compound

3. Claim : 9

Composition containing water, a particular aminofunctional organosilicon polymer, a volatile polydimethylsiloxane and a nonvolatile polydimethylsiloxane and an organic compound

4. Claim : 10

Composition containing water, a particular hydroxyfunctional organosilicon polymer, a volatile polydimethylsiloxane and a nonvolatile polydimethylsiloxane and an organic compound

INTERNATIONAL SEARCH REPORT

International Application No

PCT/JP 02/04433

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JP 63156867	A	29-06-1988	NONE

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